

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support School
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LS 401

STUDENT OUTLINE

RIG EQUIPMENT FOR EXTERNAL LIFT

LEARNING OBJECTIVES

1. Terminal Learning Objective: Given the requirement to conduct external helolift operations, tools, equipment and ensuring helolift can accomplished safely and without damage to the equipment, rig the equipment for external lift per the references. (0481.01.04)
2. Enabling Learning Objectives: Given the requirement to conduct external helolift operations, tools, and equipment, identify helicopters and their cargo capabilities per the references. (0481.01.04a)
 - a. Prepare the equipment for rigging. (0481.01.04b)
 - b. Perform an operation function test on external helolift equipment. (0481.01.04c)
 - c. Connect the rigging slings/straps to the equipment. (0481.01.04d)

OUTLINE

1. **IDENTIFY HELICOPTERS AND THEIR CARGO CAPABILITIES.**
 - a. CH-46 Sea Knight.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) CH-46E Sea Knight. A twin engine, tandem rotor helicopter manufactured by Boeing Vertol Company. The primary mission is the rapid aerial deliver of combat troops, support equipment, and supplies. The CH-46 has a total rotor diameter of 84'. It is capable of transporting 15 combat equipped troops

or 15 litters and 2 medical attendants. The CH-46 helicopter can produce downwash up to 100 mph.

(2) Cargo Capabilities.

(a) Rescue Hook. A free swiveling hook with a lifting capacity of 600 lbs. Which is located outside of the helicopter with a 100-ft of cable.

(b) Utility Winch. A free swiveling hook with a lifting capacity of 2,000 lbs. Located inside the cargo compartment.

(c) Cargo Compartment. Consists of a cargo ramp, door, rollers, and pallet guides and other accessories used for internal cargo loading and rescue operations. It is designed to support palletized loads up to a maximum of 3,000 lbs. of cargo and equipment. The cargo will be transported on a standard warehouse pallet, 40 X 48-inch or in a wire basket. The maximum number of pallets it equipped to carry is 5. Also, this helicopter has a permanent roller system.

(d) External Cargo Hook. System consists of the cargo hook, mounting beam, a mechanical safety latching device, and load arm. The aircrew normally opens the cargo hook electrically or manually. The maximum weight that can be transported externally on the CH-46E Sea Knight is 10,000 lbs.

b. CH-53D Sea Stallion.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) CH-53D Sea Stallion. A twin engine, single main rotor helicopter produced by Sikorsky Aircraft. Its primary mission is the aerial deliver of supplies. It is capable of transporting 37 combat equipped troops or 24 litters and 3 attendants. This helicopter can produce downwash up to 125 mph.

(2) Cargo Capabilities.

(a) Cargo Compartment. It has two rows of skid strip conveyors that aide in loading and unloading of palletized cargo. These rollers are designed to accommodate a 40 X 48-inch military pallet at loads up to 2,200 lbs. per pallet. The maximum number of pallets this helicopter can carry is 7.

(b) External Cargo Hook. Is used to carry loads suspended below the helicopter. It has a maximum external lifting capacity of 20,000 lbs. The aircrew can open the hook electrically or manually. A manual release knob is located on the right side of the hook.

c. CH-53E Super Sea Stallion.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) CH-53E Super Sea Stallion. A triple engine, single main rotor helicopter produced by Sikorsky Aircraft. Its primary mission is either vertical on board delivery, or aerial delivery of supplies and equipment. It is capable of transporting 55 combat equipped troops or 24 litters and 3 attendants. This helicopter can produce downwash up to 175 mph. It can also generate up to 200,000 volts of static electricity. Finally, this helicopter does have aerial refueling capabilities.

(2) Cargo Capabilities.

(a) External Cargo Hook. Designed to carry a load of 32,000 lbs externally. The CH-53E is designed to carry external loads either single point (1 pendant hook) or dual point (2 pendant hooks). The single point cargo hook system is positioned in the center of the aircraft. The dual point forward cargo hook is positioned towards the front of the aircraft and the aft hook towards the rear. The dual point system to provide additional clearance between the helicopter and the hookup. Also the dual point system was designed to increase load stability during flight when moving large bulky cargo. However all three hooks can be used to transport individual loads, one load per hook with the heaviest connected to the center hook.

(b) Cargo Compartment. Is the same as the CH-53D.

(c) Utility winches. The CH-53D and CH-53E helicopters are both equipped with two utility winches onboard.

(d) The CH-53E has centerline seating capabilities.

d. V-22 Osprey.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) V-22 Osprey. A twin engine, high wing, and tilt rotor multimission aircraft built by Bell Helicopter Textron and Boeing Helicopters. The tilt rotor design combines the vertical flight capabilities of a helicopter with the speed and range of a turboprop airplane. Its missions include troop transport, cargo transport, and aerial refueling capabilities. It is capable of transporting 24 combat equipped troops or 12 litters. Also can produce downwash up to 200 mph.

(2) Cargo Capabilities.

(a) The V-22 Osprey is capable of transporting 20,000 lbs. of cargo or equipment internally, in the cargo configuration.

(b) Cargo loading is facilitated by a cargo winch and roller rail handling system.

(c) Single point external maximum is 10,000 lbs. and dual cargo hooks permit external loads of up to 15,000 lbs.

2. **PREPARE THE EQUIPMENT FOR RIGGING.**

a. Protection and safety inspections of equipment being lifted are a must. Preparation is a very important factor when being part of a Helicopter Support Team (HST). How well you prepare your equipment will determine how aerodynamically it will fly. It should be done prior to rigging up any equipment.

(1) M998/M1038 HMMWV.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(a) All mirrors will be rigger taped and folded forward.

(b) Headlights, taillights and all marker lights will be rigger taped over.

(c) Ensure that the parking brake is in working order.

(d) With the front wheels pointed straight-ahead tie down the steering wheel with the securing device located under the dashboard.

(e) The fuel tank will not be more than $\frac{3}{4}$ full and with the fuel cap in place.

(2) M149A2 Water Trailer.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(a) Secure any loose electrical cables, air hoses, and safety chains to trailer frame with riggers tape.

(b) Ensure that the parking brake is in working order.

(c) Make sure the tongue wheel is in the locked down position.

(d) Secure the tank hatch closed.

(3) M101A1 Howitzer (105mm).

REFER TO THE STUDENT HANDOUT FOR PICTURES

(a) Close and lock the breech.

(b) Ensure that the trails are properly closed and secured with additional nylon cord or riggers tape securing the locking handle.

(c) All muzzle, breech, and barrel covers will be removed and secured.

(d) All sight mounts will be removed and padded.

(e) Ensure that the parking brakes are in working order.

(f) Use padding or riggers tape on the gun tube and the forward edge of the recoil damper assembly.

(g) Riggers tape and pad trails aft of traveling lock.

(4) Equipment preparation supplies.

(a) Padding. Can be cardboard, empty nylon sandbags, or cardboard honeycomb platform. Padding is used to

prevent damage to equipment being lifted and the lifting equipment (i.e. slings, nets, straps).

(b) Nylon cord (550 cord). Is used to secure any items inside or outside of equipment.

(c) Tape (riggers tape). Is used to protect any glass or plastic reflectors from possible damage. Also to secure items that may move during flight.

(d) Check your publications or unit Standard Operating Procedure to determine how to properly prepare any specific piece of equipment, failure to do so can result in the piece of equipment possibly being dropped or damaged during flight.

(5) Mobile loads.

(a) All mobile loads such as supplies and equipment that are within a vehicle will be properly secured. Mobile loads can be secured using nylon cord or riggers tape. Loads are secured to prevent shifting or movement while the vehicle is in flight. Special caution should be taken when securing hazardous cargo mobile loads (i.e. ammunition, fuels).

(6) Reduce vehicle height.

(a) When lifting vehicles with canvas covers and doors, the vehicle needs to be reduced in height. The canvas cover will be removed and folded up. Once removed the canvas cover can be secured inside the vehicle. If the vehicle has removable doors, they will be removed and secured inside the vehicle. If time permits the windshield should be folded forward and secured to the hood of the vehicle. Any vehicle equipped with a communication system will have the external antenna secured in the down position. The antenna can be secured with nylon cord or riggers tape.

3. PERFORM AN OPERATION FUNCTION TEST ON THE EXTERNAL HELOLIFT EQUIPMENT.

a. 15,000 lbs. Nylon sling. Has a 15,000-pound lifting capacity.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) Components.

- (a) One (1) foot in diameter nylon web ring apex.
 - (b) Four (4)-nylon sling legs that are fifteen (15) feet in length.
 - (c) Grab link with spring keeper.
 - (d) Six (6) feet of chain with 64 links (#1 link begins at the free end of the chain leg).
 - (e) Web keepers and floating keepers.
 - (f) Connector links and coupling link.
- (2) Inspection. If any of the following discrepancies are present the sling or sling leg will be rendered unserviceable.
- (a) Three or more consecutive broken and/or loose stitches.
 - (b) Five or more broken and/or loose stitches on a sling leg.
 - (c) Foreign matters such as rust that cannot be removed.
 - (d) Fraying, including broken webbing strands.
 - (e) Excessive wear or fusing indicated by unusual hardening or softening of webbing fibers.
 - (f) Cuts or broken strands in the nylon webbing.
 - (g) Any heavy oil stains or mildewed areas.
 - (h) Any missing parts such as buffers, sliding keepers, or permanent keepers.
 - (i) Metal items should be inspected for rust, corrosion, cracks, bends, distortion, burrs, sharp edges, grease, or any other foreign matter. The presence of any bends, cracks, or distortions will render that item unserviceable.
 - (j) The using unit can conduct it's own inspection. The nylon sling legs will be marked in one (1) inch letters with the date first used, not date of issue. The markings are done

in parachute marking ink. Also, if the sling is unserviceable stencil "UNSERVICABLE" on it and dispose of it through the supply channels.

(3) Storage and maintenance.

(a) Store the sling sets in a dry area protected from direct sunlight, in a manner to prevent rust, corrosion, or contact with sharp abrasive objects and the ground.

(b) The sling set has no predetermined service life.

(c) Repair will consist of removal and replacement of damaged or defective components.

(d) Spot clean the slings by gently brushing or rubbing the soiled area with a soft bristled brush or clean cloth dampened with dry cleaning solvent.

b. 40,000 lbs. Kevlar sling. Has a 40,000-pound lifting capacity.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) Components.

(a) Apex shackle is approximately twelve lbs. (12) and gold in color (rated at 40,000 lbs.).

(b) Four (4)-Kevlar sling legs that are twelve feet (12) in length and 1 1/8 in diameter (each leg rated a 10,000 lbs.).

(c) Grab link with spring keeper.

(d) Eight (8) feet of chain with 70 links (#1 link begins at the free end of the chain leg) each 10th link is painted olive drab to aid in counting links.

(e) Coupling link.

(f) The total weight of all of the components is 170 lbs.

(2) Inspection. If any of the following discrepancies are present the sling or sling leg will be rendered unserviceable.

(a) Three or more consecutive broken and/or loose stitches in the Kevlar rope of the sling leg.

(b) A total of five or more broken and/or loose stitches in the Kevlar rope of the sling leg.

(c) Kevlar webbing frayed to the extent that webbing strands are broken.

(d) Excessive Kevlar wear, especially at metal connectors.

(e) Bent, chafing, fusing, or melting of Kevlar due to heat or friction, indicated by unusual hardening or softening of web fibers.

(f) Foreign matter, such as dirt, rust, or other stains, that cannot be removed with mild detergent.

(3) Storage and maintenance.

(a) After performing preventive maintenance place sling in a sturdy container and store in a dry area away from sunlight.

(b) Sling assemblies are inspected and maintained according to the requirements of damage and corrective action criteria listed in MCRP 4-11.3E vol. I.

c. 5,000 lbs. & 10,000 lbs. Cargo nets.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) Components.

(a) 18 x 18 feet.

(b) Four (4) lifting legs.

(c) Six (6)-foot square load zone area marked by yellow cord in the center of the net.

(d) Four (4) steel hooks.

(e) Oval shaped apex.

(2) Inspection.

(a) Hooks.

1. Inspect each hook for burrs, cracks, and distortions.

2. If burrs are found on the hooks, smooth them out with a metal file.

3. If a metal hook is badly damaged or missing, the net must be replaced.

(b) Apex.

1. Run your fingers over the entire apex feeling for burrs or rough edges. You should also be looking for distortions or cracks in the apex. If burrs are found, file them off.

2. If cracks or distortions are found, replace the apex.

(c) Lifting leg.

1. Inspect the outside strap where it is looped and sewn to the border cord. Check the stitching for damage or unraveling which can be caused by abrasion. Restitch if required.

2. Inspect the lifting leg by running your hand along the length of the webbing. If there are cuts more than 1/2inch long in any direction, the lifting leg or strap must be replaced.

(d) Border cord.

1. To inspect the cord, start at the apex fitting and work around the entire net border with both hands while looking for cuts or severely abraded areas.

(3) Storage and maintenance.

(a) All cargo nets should be stored in the vinyl bag that it is packaged in and kept out of direct sunlight.

(b) All maintenance and repairs will be accomplished according to procedures in TM 10-1670-295-23 & P.

4. CONNECT RIGGING SLINGS/STRAPS TO THE EQUIPMENT.

a. General information.

(1) Adjust the length of each sling leg as necessary to assure that the load will maintain an acceptable suspension position in relation to the helicopter when lifted. Since the center of gravity of a load suspended from a single point will always fall directly below the point of suspension, the initial rigging of a particular load might result in the load tilting to an unacceptable degree on lift-off. It may be necessary to test the position of load suspension by lifting the rigged load with a hoisting device such as a wrecker truck or truck mounted crane. This test would have the same effect, except for drag, as that of having the load lifted by a helicopter. Unless standardized rigging procedures are available to the rigging personnel, it is advisable that the suspension position test be run on all sling loads that could possibly create an undesirable suspension position. In rigging vehicles, the position of load suspension is normally "nose low" for prime movers and towed loads. In loads of coupled vehicles, the position of the overall load should also be "nose low". To raise or lower one end of any given load, reposition the chain link in the grab link. It must be kept in mind that the load must maintain an acceptable flight position and be aerodynamically stable.

b. Proper placement of slings legs to the equipment.

REFER TO THE STUDENT HANDOUT FOR PICTURES

(1) The load will be rigged in the following manner.

- (a) Sling leg 1 to the left front lifting point.
- (b) Sling leg 2 to the right front lifting point.
- (c) Sling leg 3 to the left rear lifting point.
- (d) Sling leg 4 to the right rear lifting point.

(2) Refer to publications for correct linkage for the vehicle or equipment being transported externally. Once the correct linkage is known, the desired chain link is inserted passed the spring keeper into the grab link. After all of the sling legs are connected to the load, the linkage will be rechecked by the HST (HELICOPTER SUPPORT TEAM) leader.

(3) Once the linkage has been rechecked and confirmed for correctness by the team leader, all of the excess chain will be rigger taped to the sling leg. This will prevent damage to the vehicle or equipment.

c. Breakaway ties. Each sling leg should be clustered, taped, or tied together above the load and individually taped or tied to the cargo item to prevent fouling of the slings before or during hook-up. This will hold the legs in a desired position until lift-off, at which time the binding material will break and allow the sling legs to assume their normal flight position.

d. Spreader bars. Prevent the sling legs from bearing against the load, which could cause damage to the 15,000-pound nylon sling. There is no spreader bar authorized for use with the 40,000-pound sling.

e. Types of loads.

1. M998, HIGH MOBILITY MULTIPURPOSE, WHEELED VEHICLE (HMMWV).

(a) Applicability. This load is suitable for the CH-53D/E helicopter.

(b) Load description.

(1) Variance.

a. M1025 Armament Carrier.

b. M998 Cargo Troop Carrier.

c. M1035 Soft Top Ambulance.

d. M966 Tow Missile Carrier.

(2) Weight. Gross weight 7,500 pounds.

(3) Materials.

a. Sling, helicopter, cargo carrying, 15,000-pound capacity.

b. Additional nylon web ring.

- c. Tape, pressure sensitive, 2-inch width.
- d. Cord, nylon, Type III, 500 pound breaking strength.

(c) Personnel. Two persons can rig this load in 15 minutes.

(d) Single-Point Procedures.

(1) Preparation.

- a. Engage parking brake.
- b. Secure loose items outside of vehicle with nylon cord.
- c. Remove canvas and secure in vehicle bed with nylon cord.
- d. Tape or pad windows and mirrors to prevent damage.
- e. Fold in rear view mirrors.
- f. Fold rear seats and secure in place.

(2) Rigging.

- a. Route sling leg 1 through the left front lifting point on the hood. Insert link 60 into the grab link.
- b. Route sling leg 2 through the right front lifting point on the hood. Insert link 60 into the grab link.
- c. Route sling leg 3 through the rear left side tailgate slot to the left rear lifting point. Insert link 3 into the grab link.
- d. Route sling leg 4 through the rear right side tailgate slot to the right rear lifting point. Insert link 3 into the grab link.
- e. Secure excess chain with tape.
- f. Tape sling legs to prevent fouling.

g. Proceed with helicopter hookup.

(e) Dual-point procedures.

(1) Preparations. Same preparation as single point rigging procedures.

(2) Rigging.

a. Construct 2 two-legged sling assemblies using an additional apex nylon web ring.

b. One sling assembly will attach to the front hook and the other one to the rear hook.

c. Route the front sling legs through the front lifting points on the hook. Insert link 25 into the grab link.

d. Route the rear sling legs through the rear lifting points, insert link 3 into the grab link.

e. Secure excess chain with tape.

f. Tape sling legs to prevent fouling.

g. Proceed with helicopter hookup.

2. M149A1 TRAILER TRUCK, WATER, 400 GAL. 1-1/2 TON 2 WHEEL.

(a) Applicability. This load is suitable for the CH-46 or CH-53D helicopter depending on weight.

(b) Load Description.

(1) Trailer, tank, water, 400 gallons, 1-1/2 ton, 2 wheels, M149A1.

(2) Weight.

a. M149A1 without water 2,530.

b. M149A1 with 400 gallons water 6,060.

(3) Materials.

a. Sling, helicopter, cargo carrying, external, 15,000 pounds.

b. Cord, nylon, type III, 500 pound breaking strength.

c. Tape, adhesive, pressure sensitive, 2-inch width.

d. Padding material.

(c) Personnel. One person can rig this load in 10 minutes.

(d) Single point procedures.

(1) Preparation.

a. Secure the light cable, air hose, and safety chains with cord.

b. Engage the parking brake.

(2) Rigging.

a. Route the two outer legs (1 and 2) to the right and left front lifting points.

b. Pass the chain through its respective eye and insert link 3 into the grab link.

c. Route the two inner legs (3 and 4) to the right and left rear lifting points.

d. Pass the chain through its respective eye and insert link 11 into the grab link.

e. Tape the sling legs together and coil them atop the load.

f. The two rear legs (3 and 4) may rub against the tank during flight. Tie or tape padding material to sling legs.

g. Proceed with helicopter hook-up.

(e) Dual-point procedures.

(1) Preparations.

- a. Same preparation as single point.

(2) Rigging.

- a. Construct 2 legged slings with additional apex nylon web ring.

- b. Attach the first (front) sling (Legs) to the right and left front lifting points. Insert link 22 into the grab links.

- c. Attach the second (rear) sling (Legs) to the right and left rear lifting points. Insert link 2 into the grab hooks.

- d. Tape the sling legs together.

- e. The two rear sling legs (3 and 4) may rub against the tank in flight. To prevent this tie or tape padding to the sling legs.

- f. Proceed with helicopter hook-up.

3. M101A1 HOWITZER LIGHT, TOWED 105 MM.

(a) Applicability. This load is suitable for the CH-46, CH-53 helicopters.

(b) Load description.

- (1) Howitzer, light, towed, 105mm, M101A1.

- (2) Weight. 5,500 pounds.

- (3) Materials.

- a. Sling, cargo, chain leg, 15,000-pound capacity.

- b. Cord, nylon, Type I, 500 pound breaking strength.

- c. Tape, pressure sensitive, 2-inch width.

- d. Padding material.

(c) Personnel. Two persons can rig this load in 15 minutes.

(d) Single point procedures.

(1) Preparation.

a. Tape or tie padding material around gun tube, recoil damper and mounting, and trail.

b. Secure trails together. Secure the trail closing lock.

c. Remove or secure gun tube cover handle to the left trail-lifting handle with nylon cord.

d. Secure any extra equipment in place. Place the gun section equipment on trail and secure with one CGU-1B cargo strap.

(2) Rigging.

a. Route the two outerlegs (1 and 2) around the gun tube. Place the grab link for leg 1 on the left side of the tube and wrap the chain around twice over the padded area. Insert link 22 into the other grab link.

b. Repeat the above procedure for leg 2 on the right side of the tube.

c. Hook the inner legs (3 and 4) to the trails. Pass the chain for leg 3 around the padded area of the left trail and insert link 3 into the grab link, repeat for leg 4 on the right trail.

d. Tape sling legs together to prevent fouling.

e. Proceed with helicopter hook-up.

f. Follow the reverse procedures to derig the load.

g. For rigging an accompanying load of ammunition, place a 15,000-pound sling under the trails of the howitzer with the nylon web ring centered between the padded areas. Route sling legs 1 and 3 to one side and sling legs 2

and 4 to the other under the trails. Bring the sling legs over the padded portion of the trails and route them down through the nylon web ring. Up to three A-22 air delivery containers at 2,000 pounds each or a 5,000 or 10,000 pound cargo net may be used to transport palletized ammunition.

(e) Dual-point procedures.

(1) Preparation.

a. Same preparation as single point through an additional apex is required.

(2) Rigging.

a. Construct two legged sling assemblies using an additional web ring.

b. Wrap the first sling assembly (legs 1 and 2) around the gun tube as in single point rigging. Insert chain link 9.

c. Hook the second sling assembly (legs 3 and 4) to the trail as in point rigging. Insert chain link 9.

d. Route the CGU-1B cargo strap around the sling legs and between the gun tube and the recoil damper.

(CAUTION: IF THE SLING LEGS ARE NOT SECURED BY CARGO STRAP WHEN USING THE DUAL-POINT SYSTEM, THE SLING LEGS WILL SLIP OFF THE GUN TUBE CAUSING THE GUN TO BE DROPPED.)

e. Proceed with helicopter hook-up.

REFERENCES:

1. MCRP 4-11.3E Volume I. Multiservice Helicopter Sling Load: Basic Operations and Equipment.
2. MCRP 4-11.3E Volume II. Multiservice Helicopter Sling Load: Single-Point Load Rigging Procedures.
3. MCRP 4-11.3E Volume III. Multiservice Helicopter Sling Load: Dual-Point Load Rigging Procedures.
4. A1-V22AA-NFM-000. V-22 Osprey Operations